



Consultative Webinar

Waste Sector Emissions & Bottom-Up Policy Inputs for NDCs in Pakistan

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Authors: Nelam Pari and Sajjad Ullah

Executive summary

Pakistan's waste sector is emerging as a critical yet underleveraged component of the country's climate mitigation agenda. With national greenhouse gas (GHG) emissions exceeding 400 MtCO₂e, the waste sector contributes approximately 8–9% of total emissions and nearly 20% of methane emissions a potent short-lived climate pollutant. Pakistan generates over 49 million tonnes of municipal solid waste annually, of which 50–60% is organic, creating substantial methane generation potential due to widespread open dumping and limited landfill gas recovery systems.

Under its Nationally Determined Contributions (NDC 3.0), Pakistan has committed to reducing projected emissions by up to 50% by 2035 (conditional upon international support), with explicit recognition of improved solid waste management, methane reduction, and circular economy approaches as priority mitigation areas. However, despite this policy recognition, waste-sector mitigation remains insufficiently integrated into operational climate planning, Monitoring, Reporting and Verification (MRV) systems, and municipal governance frameworks.

Asif Iqbal et al. (2024) demonstrates that Pakistan's municipal solid waste system is constrained by fragmented institutional mandates, weak fiscal decentralization, limited cost recovery mechanisms, and insufficient integration of informal recycling chains. Meanwhile, systems-based analysis highlights significant mitigation potential through composting, anaerobic digestion, landfill gas capture, and improved material recovery particularly given the high organic composition of the waste stream.

In response to these structural gaps, the Sustainable Development Policy Institute (SDPI) convened a consultative webinar titled “Waste Sector Emissions & Bottom-Up Policy Inputs for NDCs in Pakistan” (2nd March 2026). The session initiated a structured dialogue among policymakers, researchers, practitioners, municipal actors, and informal waste workers to bridge the disconnect between practice and national climate policy. A key outcome was the proposal to establish a Waste Sector Emissions Working Group to generate technical, bottom-up inputs into Pakistan's NDC implementation process.

The report deliberated that waste must be reframed not merely as an environmental management issue but as a strategic climate mitigation lever and economic opportunity. Aligning municipal solid waste governance with national climate commitments requires institutional coordination, inclusive stakeholder engagement, climate finance mobilization, and a systemic transition from a linear “collect–transport–dump” model toward a circular economy framework.

Background and Objectives

Pakistan is among the most climate-vulnerable countries globally while also experiencing rapidly increasing greenhouse gas emissions. Total national emissions have surpassed 400 MtCO₂e, driven primarily by the energy, agriculture, and industrial sectors. However, the waste sector is emerging as a growing contributor, accounting for approximately 8–9% of total emissions and nearly one-fifth of national methane emissions. Given methane's high global warming potential and relatively short atmospheric lifetime, targeted mitigation in the waste sector presents an important opportunity for achieving near-term climate gains while strengthening long-term environmental resilience.

Pakistan generates more than 49 million tonnes of municipal solid waste annually. Average per capita waste generation is estimated at approximately 0.6 kg per day and exceeds 1 kg per day in major urban centers. The waste stream is characterized by a high organic fraction, comprising approximately 50–60% of total municipal waste. This composition significantly increases methane generation potential when waste is disposed of in unmanaged dumpsites or poorly controlled landfill conditions. Collection efficiency in urban areas ranges between 60–75%, while coverage remains considerably lower in peri-urban and rural regions. A substantial proportion of collected waste is ultimately disposed of through open dumping rather than engineered sanitary landfills equipped with methane capture systems, contributing directly to rising emissions and associated environmental and public health risks.

Rapid urbanization, demographic expansion, and evolving consumption patterns are projected to further increase waste generation volumes in the coming decade. Without structural improvements in waste management systems, emissions from the sector are expected to grow correspondingly. At the same time, the high proportion of biodegradable waste indicates substantial technical mitigation potential through composting, anaerobic digestion, landfill gas recovery, and decentralized biogas systems. Enhanced material recovery and recycling systems also offer economic opportunities aligned with circular economy principles, supporting resource efficiency and green job creation.

Despite this mitigation potential, Pakistan’s municipal solid waste system remains predominantly focused on collection and disposal rather than resource recovery and emissions reduction. Institutional and governance constraints continue to limit progress. Responsibilities for waste management are distributed across federal, provincial, and local tiers, often without clearly defined coordination mechanisms or harmonized planning frameworks. Municipal authorities frequently face fiscal limitations, weak cost-recovery systems, and inadequate technical capacity to invest in climate-aligned infrastructure. Monitoring, Reporting and Verification (MRV) systems for waste-sector emissions remain underdeveloped, resulting in data gaps that constrain evidence-based planning and access to climate finance.

The informal sector plays a significant yet largely unrecognized role in Pakistan’s recycling ecosystem. Informal waste workers contribute to material recovery and value-chain efficiency but operate without formal recognition, occupational safeguards, or systematic integration into municipal waste management strategies. Strengthening linkages between informal actors and formal systems represents an opportunity to improve recycling performance, reduce emissions, and enhance inclusive economic participation.

Pakistan’s updated Nationally Determined Contributions (NDC 3.0) acknowledge the importance of improving solid waste management, reducing methane emissions, and promoting circular economy approaches as part of the country’s broader mitigation strategy. The commitment to reduce projected emissions by up to 50% by 2035, conditional upon international support, underscores the need for sector-wide reforms. However, translating national commitments into operational mechanisms at subnational and municipal levels remains a key implementation challenge. Gaps persist in financing models, institutional coordination, technical planning capacity, and stakeholder integration.

Addressing these structural constraints is essential for repositioning the waste sector as a core component of Pakistan’s climate mitigation framework. Strengthening governance alignment, enhancing data systems, mobilizing climate finance, and integrating inclusive approaches into municipal waste management can

enable the sector to contribute meaningfully to national emission reduction targets while supporting urban resilience and sustainable economic development.

Webinar Objectives

The webinar will:

- Highlight the contribution of waste-sector methane emissions to Pakistan’s climate profile.
- Explore the link between Zero Waste practices and methane mitigation.
- Identify practical challenges faced by practitioners in scaling emissions-reducing interventions.
- Discuss gaps in existing policy and NDC frameworks related to the waste sector.
- Introduce the Waste Sector Emissions Working Group and outline the way forward.

Key insights

Ms. Zaineb Naeem (Associate Research Fellow – Ecological Sustainability & Circular Economy, SDPI) framed the current challenges of Pakistan’s waste sector, emphasizing both structural and social dimensions. She noted that approximately 90% of waste collection and management occurs in the informal sector, which results in fragmented data collection and significant gaps in evidence for policy planning. Open dumping remains prevalent due to the lack of designated landfill sites, inadequate waste collection infrastructure, and low prioritization of the sector within national climate and development agendas.

Organic and food waste constitute a major portion of the municipal solid waste stream, yet they are largely unmanaged, contributing substantially to methane emissions and environmental degradation. The private sector often relies on imported or non-standard practices that are misaligned with sustainable waste management principles, further complicating mitigation efforts. Ms. Naeem also highlighted global initiatives, such as UNEP’s 5.3 program on plastic pollution, to underline the need for Pakistan to integrate its waste management strategies with international climate priorities.

She concluded that effective interventions must include improved waste segregation, expansion of formal collection and disposal systems, integration of informal workers into data and operational frameworks, and multi-stakeholder coordination. Addressing these challenges is essential for reducing emissions, improving environmental health, and developing actionable, data-driven policies that accurately reflect on-the-ground realities.



Fig 1: Ms. Zaineb Naeem is Highlighting the key Challenges of the Waste Management Sector

Mr. Muhammad Arif Goheer (Executive Director – Global Climate-Change Impact Studies Centre, GCISC) underscored the critical yet underrecognized role of the waste sector in Pakistan’s climate agenda. Drawing on the latest National Greenhouse Gas Inventory (2024) and Pakistan’s Third Nationally Determined Contribution (NDC 3.0), he highlighted that the waste sector contributes approximately 8% of the country’s total greenhouse gas emissions, with methane emissions significantly higher than carbon dioxide equivalents due to unmanaged organic decomposition. He noted that Pakistan generates around 45 million tons of municipal solid waste annually, driven by rapid urbanization and rising consumption, with per-capita generation averaging 0.6–0.65 kg/day, and reaching 1–1.2 kg/day in major cities such as Karachi and Lahore. Mr. Goheer stressed that about 50–60% of this waste is organic, presenting substantial mitigation potential through anaerobic digestion, composting, recycling, and energy recovery. However, he expressed concern that 64–70% of collected waste continues to be openly dumped or disposed of in unregulated sites, reflecting persistent gaps in management, policy enforcement, and infrastructure.

Mr. Goheer further emphasized that current GHG inventories still rely largely on default emission factors, limiting the fidelity of waste emissions estimates, and that Pakistan’s waste data systems require strengthening through robust Monitoring, Reporting, and Verification (MRV) frameworks to support transparent tracking and access to climate finance. He pointed out that while the NDC 3.0 articulates ambitious goals—to reduce projected emissions by up to 50% by 2035 (17% unconditional; 33% conditional)—the waste sector must be strategically integrated into implementation pathways through enhanced policy frameworks, dedicated investment, and cross-sectoral coordination. Strengthening the capacity of local governments, integrating informal sector actors, and adopting low-cost, technically

feasible solutions such as engineered landfills, decentralized composting, and methane capture systems can both reduce emissions and generate multiple co-benefits, including improved public health, job creation, recycling markets, and renewable energy generation. Mr. Goheer concluded that science-based policy inputs, realistic yet ambitious targets, and strong MRV and financing mechanisms are essential to transform the waste sector into a key contributor to Pakistan's climate resilience and sustainable development.



Fig 2: Mr. Muhammad Arif Goheer is Setting the Context

Dr. Ayesha Khan (CEO – Akhter Hameed Khan Foundation) highlighted practical challenges in household waste collection and barriers faced by the informal sector, including storage limitations and lack of technology. Drawing lessons from Bangladesh and Sri Lanka, she emphasized that financially viable models and municipal linkages are critical, stating that waste only becomes valuable when backed by sustainable economic incentives.

Effective implementation of waste management strategies requires the engagement of multiple stakeholders, including civil society, households, government/municipal authorities, the informal sector, and industry. Community-level segregation and composting initiatives have shown promise, but face awareness and structural challenges at the household level. Issues such as inadequate storage, recycling difficulties, and barriers to transportation hinder progress.

The informal sector plays a crucial role in waste collection, and models from countries like Bangladesh demonstrate the potential for functional working relationships between informal workers and municipal organizations. Local-level sorting, segregation, and composting initiatives, such as those implemented by IRCS (International Rescue Committee) in Pakistan, can create employment opportunities, improve health benefits, and generate income.

Engaging IRCS at the union council level can facilitate the implementation of low-cost models, as seen in India and Bangladesh. NGOs can play a vital role in connecting local communities to contractors and IRCS, promoting segregation and composting practices. However, building trust and addressing social taboos surrounding waste management remain essential. Sustained training and capacity-building efforts are necessary to support these initiatives and ensure their long-term success.



Fig 3: Dr. Ayesha Khan Highlighted Practical Challenges in Household Waste

Ms. Rabia Razzaque (Senior Programme Officer – International Labour Organization, ILO) highlighted that Pakistan's Nationally Determined Contributions (NDCs) often focus heavily on technology while underestimating human behavior, worker welfare, and the critical role of the informal sector in waste management. She stressed that informal waste workers, many of whom are women and children, should be recognized as environmental service providers and considered central to economic transition strategies. Formalizing this sector through cooperatives, contracts, and social protection schemes can improve livelihoods, provide collective bargaining power, and ensure occupational safety and health standards. Ms. Razzaque emphasized the importance of skills development, both technical such as landfill segregation and green skills for sustainable waste management, alongside infrastructure for waste segregation to reduce volumes and enhance recycling efficiency. Mapping stakeholders across the waste

value chain helps identify vulnerable groups, market opportunities, and areas for value addition, while social dialogue and engagement of workers in policy formulation foster a sense of ownership and inclusion. By addressing these issues, Pakistan can advance a just transition that strengthens human capital, reduces exposure to pollutants, and builds a more inclusive, climate-resilient, and sustainable waste management sector.



Fig 4: Ms. Rabia Razzaque is Discussing the Role of `NDC's

Mr. Hafiz Shafiq (Informal Waste Worker Representative – Crush Factory, Sahiwal) highlighted ground-level operational processes of collection, crushing, and distribution of recyclable materials. He pointed out the absence of facilities that convert crushed plastic into finished products and emphasized the importance of maintaining safety standards for workers.

Mr. Hafiz Shafiq, an informal waste worker representative, highlights the significant challenges faced by waste workers in Sahiwal, including the lack of local crushing facilities, which forces them to travel long distances to access such services. The absence of local crushing facilities not only increases transportation costs but also decreases the financial viability of waste collection and processing activities. Furthermore, Mr. Shafiq emphasizes that waste workers are not provided with adequate personal protective equipment (PPE), exacerbating their vulnerability to health risks. When questioned about the role of government support, he stressed the need for provision of PPE and awareness-raising initiatives, citing the efforts of organizations like SDPI.

Regarding waste segregation, Mr. Shafiq emphasized the importance of separating waste by color, which would facilitate more efficient processing and recycling. He called upon government agencies and organizations like SDPI to provide awareness and training on proper waste segregation practices, underscoring the need for collective action to address the challenges faced by informal waste workers. By

addressing these infrastructure gaps and providing necessary support, it is possible to improve the working conditions and livelihoods of waste workers, while also promoting more sustainable waste management practices.



Fig 5: Mr. Hafiz Shafiq is highlighting the informal sector

Ms. Angel Imdad (CEO – Irverde) highlighted that waste is fundamentally a design issue, emphasizing that segregation-at-source is the most effective and cost-saving intervention. She stressed the importance of shifting policy focus from landfill reduction to material recovery systems while ensuring occupational health and safety compliance. The waste management sector in Pakistan faces significant challenges, with cities like Karachi generating approximately 16,500 tons of waste per day and Lahore producing around 5,000 tons. The informal sector serves as the backbone of waste management, yet it remains under-integrated, under-resourced, and often overlooked, with human resources excluded from formal planning. Critical gaps exist in integrated waste management solutions, infrastructure for wet and dry waste segregation, and effective collection from point sources. Organic waste, if not properly managed, contributes significantly to methane emissions which are far more harmful than carbon emissions highlighting the urgent need for separate collection and processing.

The lack of robust data on waste generation, recycling, and upcycling practices hinders policy development and limits opportunities for carbon financing mechanisms. Collected data on waste streams, emissions, and recovery rates should be systematically analyzed and shared with clients to inform interventions and track progress. Initiatives like the Haryali Hub aim to address some of these challenges, but significant

resource investment and coordinated efforts are still required. Additionally, the engagement of women at the grassroots level is crucial, particularly in collection and segregation activities, though their contributions often go unrecognized and access to resources remains limited. Transitioning the focus from collection volumes to material recovery and landfill diversion can mitigate methane emissions, create equitable livelihoods, and unlock opportunities for sustainable financing. A holistic approach incorporating occupational health, vaccination programs, capacity-building, and policy integration is essential to build a more sustainable and climate-resilient waste management system in Pakistan.



Fig 6: Ms. Angel Imdad is discussing on Implementation barriers

Mr. Shibu K.N. (GAIA Asia Pacific) highlighted that the waste sector is the third-largest source of anthropogenic methane globally. He introduced GAIA's "Zero Waste to Zero Emissions" campaign and stressed systemic supply-chain redesign, particularly in plastics, to achieve meaningful emission reductions.

The waste sector is a significant contributor to anthropogenic methane emissions, ranking as the third largest source and accounting for 20% of global emissions. The production, processing, and disposal of waste result in substantial greenhouse gas (GHG) emissions, with approximately 1 billion tonnes of food waste generated annually, equivalent to one-third of global food production. The climate impacts of waste management are far-reaching, with the incineration process alone contributing 70% of waste-related GHG emissions, as highlighted in the Circularity Gap Report. The production and disposal of plastics, in

particular, have devastating climate impacts, reflecting the need for urgent action to address the global plastic crisis.

The Zero Waste hierarchy offers a framework for mitigating climate change by avoiding landfill methane emissions, reducing GHG emissions, and promoting soil carbon storage. Waste-to-energy initiatives, however, can undermine climate mitigation efforts, emphasizing the importance of prioritizing recycling and waste reduction strategies. Recycling has significant mitigating potential, with avoided emissions from incinerators estimated to be substantial. For instance, recycling 1 tonne of plastic can avoid 1.43 tonnes of fossil fuel emissions, even after energy recovery. The benefits of Zero Waste are clear, including improved public health, job creation in the informal sector, and a game-changing impact on climate change mitigation.



Fig 6: Mr. Shibu K.N is presenting his slides

Policy Recommendationaions

The waste management sector in Pakistan is a significant contributor to greenhouse gas emissions, ranking as the third-largest source of anthropogenic methane globally. Cities such as Karachi and Lahore generate approximately 16,500 and 5,000 tons of waste per day, respectively, with the informal sector serving as the backbone of collection, segregation, and recycling activities. Despite their critical role, informal waste workers face severe challenges, including lack of protective equipment, absence of local processing facilities, inadequate wages, and limited integration into formal systems. Organic waste contributes disproportionately to methane emissions, while plastics and other non-biodegradable materials exacerbate the climate impact of waste. The absence of robust data on waste generation, recycling, and

upcycling further evidence-based policymaking. Effective waste management requires systemic redesign, integration of stakeholders, investment in infrastructure, promotion of circular economy solutions, and sustainable financing mechanisms. Lessons from international models in Bangladesh, Sri Lanka, and India demonstrate the importance of community engagement, municipal linkages, and financially viable local initiatives. Mandate segregation-at-source for wet, dry, and hazardous waste across households, industries, and commercial establishments, including separation by color for plastics to improve processing efficiency.

- Develop incentive frameworks for corporates, industries, and municipalities adopting effective segregation, recycling, and upcycling practices, including tax rebates, subsidies, and recognition awards.
- Recognize and integrate informal waste workers as essential stakeholders, including cooperative structures, formal contracts, and livelihood protections to improve accountability and efficiency
- Ensure occupational health and safety for all waste workers, providing personal protective equipment (PPE), insurance, vaccination programs, and regular health check-ups.
- Enhance women's participation in collection, segregation, and recycling, providing training, protective gear, and financial incentives to empower marginalized groups.
- Invest in integrated waste management infrastructure, including material recovery facilities (MRFs), composting units, anaerobic digestion plants, local crushing and processing facilities, and wet-dry waste separation systems.
- Prioritize organic waste treatment to reduce methane emissions through composting, biogas, or other anaerobic digestion technologies.
- Promote Zero Waste and circular economy approaches, emphasizing waste reduction, recycling, and material recovery over incineration or landfill disposal, particularly for plastics.
- Establish a centralized waste data and monitoring system capturing generation, collection, recycling, upcycling, and emissions, and share this data with stakeholders for informed policymaking.
- Shift policy focuses on landfill reduction to resource recovery and climate mitigation, leveraging carbon financing and trading mechanisms tied to avoid methane and GHG emissions.
- Support public-private-community partnerships, linking municipalities, NGOs, community organizations, and industry for effective local-level segregation, composting, and recycling initiatives.
- Encourage Extended Producer Responsibility (EPR) policies for industries to internalize waste management, reduce packaging waste, and promote sustainable product lifecycles.
- Facilitate capacity-building and technical training for municipal staff, informal workers, and corporate actors to strengthen operational efficiency, safety compliance, and adoption of best practices.
- Enable municipal linkages and economically viable models for household-level segregation, storage, and collection, drawing on lessons from Bangladesh, Sri Lanka, and India.
- Build community awareness and trust, addressing social taboos, providing education, and promoting collective action to improve waste management practices.

- Encourage technology-driven solutions, including waste-to-energy (where appropriate), real-time collection optimization, and recycling innovations that maximize resource recovery.
- Align municipal, provincial, and federal policies for integrated governance, establishing cross-sectoral task forces to monitor implementation, ensure compliance, and coordinate among health, environment, and industry ministries.
- Promote financially sustainable models for the informal sector, including cost-effective local crushing facilities, support for transportation of recyclables, and income-generating opportunities through local composting and recycling initiatives.

Annexure 1. Agenda of “Waste Sector Emissions & Bottom-Up Policy Inputs for NDCs in Pakistan”

Time	Session	Speaker(s)
01:00 PM – 01:10 PM	Welcome Remarks	Ms. Zaineb Naeem Associate Research Fellow – Ecological Sustainability & Circular Economy, SDPI
01:10 PM – 01:25 PM	Setting the Context: Waste Sector Emissions & Climate Commitments in Pakistan — Overview of methane emissions — Gaps in NDC treatment — Importance of bottom-up inputs	Mr. Muhammad Arif Goheer, Executive Director of the Global Climate-Change Impact Studies Centre (GCISC) (TBC)
01:25 PM – 01:55 PM	Session 1: Practice-Based Perspectives — Composting & organics management — Informal sector integration — Segregation & material recovery — Implementation barriers	Invited Practitioners (TBC) 1. Ms. Ayesha Khan, CEO of Akhter Hameed Khan Foundation 2. Ms. Rabia Razzaque, Senior Programme Officer, International Labor Organisation 3. Suthra Punjab Representative 4. Angel Imdad, CEO, Irverde 5. Mr. Hafiz Shafiq(Crush

		Factory, Sahiwal), Informal Waste Worker Representative
01:55 PM – 02:15 PM	Moderated Discussion — Policy gaps — Realistic NDC — interventions — Practice-to-policy linkages	Moderated by: Amna Urooj Research Associate, SDPI
02:15 PM – 02:20 PM	Introducing the Waste Sector Emissions Working Group — Purpose & scope — Participation model — Next steps	SDPI Team
02:20 PM – 02:25 PM	Special Remarks	Ms. Sumana, GAIA Asia Pacific / Mr. Shibu K.N.,